OSTEOPROSTHETIC CERAMIC MEMBER

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SPECIFICATION

WHAT IS CLAIMED IS:

1. An osteoprosthetic ceramic member, a plurality of which are filled into a bone defect space in accordance with the size of the bone defect space and, in a state in which protruding portions of the respective members cross each other, form three-dimensional gaps allowing outgrowth and penetration of bone, said osteoprosthetic ceramic member being characterized in having a plurality of protrusions formed integrally on a surface portion of a main body formed of alumina, calcium phosphate, or other ceramic material.

DETAILED DESCRIPTION OF THE INVENTION

This invention relates to a ceramic member for filling and supplementing bone defect portions in orthopedic surgery, oral

surgery, and other medical fields.

Members that are filled in bone defects of living bodies, such as excised portions of bone tumors and portions excised due to bone damage resulting from traffic accidents, industrial accidents, etc., to promote outgrowth of new bone and achieve quick repair of bone are preferably members having shapes such that the filled members do not move and yet form numerous gaps that enable outgrowth and penetration of bone and having such physical properties as good compatibility with living tissue, high mechanical strength, etc.

Conventionally, for such a bone defect portion, from which bone has been removed, a bone transplant from a patient's own ilium, fibula, or other autologous bone from a body portion with comparative leeway in bone amount is generally performed, and dried calf bone has been used in some cases. Although the former case is most suited for promoting the outgrowth of new bone, there are significant restrictions in collecting the necessary amount of bone for performing filling, and the latter case is hardly employed presently due to causing immunoreactions and other problems after embedding into a living body.

As members to be used for the above-described filling that take the place of bone, ceramic beads, etc., have been proposed,

and although these do not exhibit harmful properties against living bodies and are extremely good in compatibility with tissue, because these members are of spherical, elliptical, or other shape without sharp corners, the individual beads move readily even when a small external force acts after filling a bone defect portion.

The outgrowth of new bone is thus hindered and, in some cases, the members may fall out from the bone defect portion into which the members were filled.

Also, because depending on the filling conditions, an excessively filled state tends to arise, and because there are cases in which gaps into which bone can grow and penetrate are extremely few, ceramic beads have not been used widely in orthopedic fields as prosthetic members for filling bone defect portions even though these members are harmless to the living body and good in compatibility.

This invention provides an osteoprosthetic ceramic member that has been developed in view of the above circumstance, and embodiments shall now be described in detail.

In FIG. 1 to FIG. 3, reference numerals 1, 2, and 3 respectively denote osteoprosthetic ceramic members according to this invention, and ceramic member 1 has cylindrical protrusions 12 that are formed integral to a spherical body

11 that makes up a main body, with protrusions 12 being positioned at substantially equal intervals on spherical body 11 and having tips 12a that are not sharp but are all of rounded shape. As a method for manufacturing such a ceramic member 1, a slip, in which a ceramic powder raw material is mixed with water and an organic binder, is poured into a predetermined plaster mold, taken out after dehydration, and then dried and sintered to manufacture the ceramic member.

Also, with ceramic member 2, shown in FIG. 2, four columnar protrusions 21, each having a substantially rectangular cross-sectional shape, and two cylindrical protrusions 22 are formed integrally on a main body, and with both rectangular columnar protrusions 21 and cylindrical protrusions 22, sharp portions are not formed on corresponding tip portions 21a and 22a and all outer peripheral portions are rounded. As a method for manufacturing such a ceramic member 2, a ceramic raw material powder is filled into a predetermined mold, press molded, and sintered to manufacture the ceramic member.

Furthermore, a main body of ceramic member 3, shown in FIG. 3 has six vane-like protrusions 31, has a hole 32 that opens in axial directions at an axial center portion, and all outer peripheral surfaces, etc., of vane-like protrusions are rounded. As a method for manufacturing such a ceramic member

3, water and an organic binder are added to a ceramic raw material powder and wet kneading is performed, and this mixture is extrusion molded using a predetermined mold, cut into desired lengths, and then sintered.

Filling with a necessary number of such ceramic members 1 (2, 3) is performed according to the size of a bone defect portion, and when the plurality of the members are filled in the bone defect portion, protrusions 12 (21, 22, 31) thereof cross each other to form a strong structural body, and consequently, the movement of individual ceramic members 1 (2, 3) is restrained and outgrowth and penetration of bone into three-dimensional gaps formed by the mutual crossing of protrusions 12 (21, 22, 31) are allowed, thereby promoting bone repair. From relationships among mechanical strength, thickness of bones at corresponding human body locations, sizes of bone defect portions, etc., each protrusion 12 (21, 22, 31), for practical use, is suitably 0.5 to 5mm in length and preferably approximately 1 to 3mm in length, 0.5 to 3mm and preferably approximately 1 to 2mm in diameter or thickness, and as the total length, no more than 15mm and preferably approximately 5 to 10mm, and it has been confirmed from animal experiments that in the above case, it is effective for the number of protrusions to be no less than 1 and preferably

approximately 3 to 8.

As the ceramic making up the main body of each of ceramic members 1, 2, and 3, alumina or a calcium phosphate based material, such as hydroxyapatite, is suitable. Both of these ceramic materials are harmless to living bodies and excellent in compatibility with living tissues, and the former is absolutely inert to living bodies and especially high in mechanical strength. Meanwhile, because the latter, calcium phosphate based ceramic exhibits bioactive properties, promotes binding with bone, and, depending on conditions, has a property of becoming absorbed by living bodies and becoming replaced by bone, the two types of ceramic should be used according to case.

Preferably to prevent irritation of natural bone, avoid concentration of stress, etc., the outer peripheral portions of these ceramic members are not provided with sharp portions and are rounded in their entireties.

As described above, the ceramic member according to this invention, which is for filling bone defect portions and has one or more protrusions, contributes greatly to medical fields and thus to human welfare in that solitary filling with just the members can be performed when a gap resulting from bone excision is comparatively small, and even in cases where the

gap of a defect portion is large and combined use with natural bone is to be made, the natural bone filling amount, that is, the bone collection amount can be reduced significantly, and moreover, because protrusions provided on the ceramic members cross each other to form a strong structural body, movement of the individual members within a living body is restrained and excellent fixing properties are provided, and outgrowth and penetration of new bone into three-dimensional gaps of arbitrary shapes that are formed by the mutual crossing of the protrusions are promoted to achieve early recovery of the forms and functions of bones of patients.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 to FIG. 3 are respectively perspective views of embodiments of osteoprosthetic ceramic members according to this invention.

1, 2, 3: ceramic member, 12, 21, 22, 31: protrusion

Fig.1

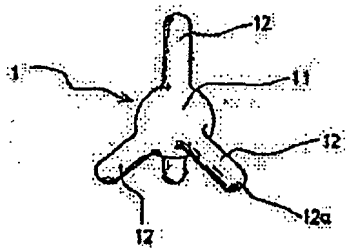

Fig.2

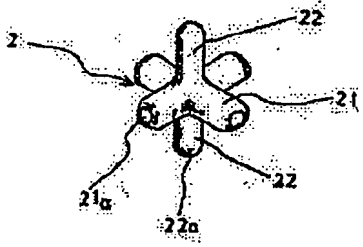

Fig.3